

AMENDMENTS TO THE CLAIMS

Claim 1. (Currently Amended) A sensor node comprising at least one substrate coupled among at least one processor and at least one energy source, and further comprising at least one antenna incorporated in or carried on the at least one substrate, wherein the at least one substrate is at least one sensor, wherein functions of the sensor node are remotely controllable and the sensor node is programmable via wireless internetworking among a plurality of network elements, wherein the at least one substrate is flexible, and wherein the at least one substrate physically supports the at least one processor and the at least one energy source.

Claim 2. (Original) The sensor node of claim 1, wherein the at least one substrate comprises active and passive substrates.

Claim 3. (Original) The sensor node of claim 2, wherein the at least one substrate comprises at least one thin film substrate, wherein the at least one thin film substrate comprises a piezoelectric polymer film, wherein the piezoelectric polymer film is polyvinylidenedifluoride (PVF₂).

Claim 4. (Original) The sensor node of claim 1, wherein the at least one substrate is conformal.

Claims 5-8. (Canceled)

Claim 9. (Original) The sensor node of claim 1, further comprising at least one communication physical layer including radio frequency (RF) power management.

Claim 10. (Original) The sensor node of claim 1, wherein the at least one processor is coupled to at least one component selected from a group consisting of actuators, sensors, signal processors, interfaces, power supplies, data storage devices, and communication devices.

Claim 11. (Original) The sensor node of claim 1, wherein the at least one sensor comprises at least one sensor selected from a group consisting of passive and active sensors, wherein the passive and active sensors include seismic sensors, acoustic sensors, optical sensors, infrared sensors, magnetic sensors, thermal sensors, accelerometers, and bi-static sensors.

Claim 12. (Original) The sensor node of claim 1, wherein the at least one energy source includes a thin film photovoltaic device, wherein the thin film photovoltaic device is an energy source and an optical presence detection sensor.

Claim 13. (Original) The sensor node of claim 1, wherein the sensor node is coupled to at least one item selected from a group consisting of machinery components, electronic equipment, mechanical equipment, electro-mechanical equipment, a facility, a structure, a material, a biological system, people, animals, vegetation, clothing, crates, packages, product containers, shipping containers, a transportation system, vehicle components, an outdoor area, and an indoor area.

Claim 14. (Original) The sensor node of claim 1, wherein the at least one sensor receives at least one signal type selected from a group consisting of temperature, shock, vibration, motion, acceleration, tip, light, sound, and package opening and closing.

Claim 15. (Canceled)

Claim 16. (Currently Amended) The sensor node of claim 1, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the at

least one node is coupled among a monitored environment and at least one client computer, wherein functions of the at least one node are remotely controllable using the at least one client computer, wherein the at least one node provides node information including node resource cost and message priority to the plurality of network elements, wherein data processing is distributed through the sensor network in response to the node information.

Claim 17. (Canceled)

Claim 18. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network including at least one node and at least one client computer, and wherein the sensor node is coupled to the at least one client computer through the plurality of network elements, wherein the at least one node supports at least one communication mode selected from a group consisting of wireless communications, wired communications, and hybrid wired and wireless communications, wherein at least one redundant communication pathway is established among the plurality of network elements.

Claim 19. (Canceled)

Claim 20. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise at least one network, and wherein the at least one network includes wired networks, wireless networks, and hybrid wired and wireless networks, wherein the at least one network comprises at least one network selected from a group comprising the Internet, local area networks, wide area networks, metropolitan area networks, and information service stations.

Claim 21. (Original) The sensor node of claim 1, wherein the internetworking comprises providing remote accessibility using World Wide Web-based tools to data, code, management, and security functions, wherein data includes signals and images, wherein code includes signal

processing, decision support, and database elements, and wherein management includes operation of the plurality of network elements.

Claim 22. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a plurality of network element sets that are layered.

Claim 23. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the at least one node comprises a plurality of node types, wherein the plurality of node types includes at least one node of a first type and at least one node of a second type, wherein a first network having a first node density is assembled using the at least one node of a first type, wherein a second network having a second node density is assembled using the at least one node of a second type, wherein the second network is overlayed onto the first network.

Claim 24. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network, and wherein code and data anticipated for future use are predistributed through the sensor network using low priority messages, wherein the code and the data are downloadable from at least one location selected from a group consisting of storage devices of the plurality of network elements, and storage devices outside the sensor network.

Claims 25 and 26. (Canceled)

Claim 27. (Currently Amended) The sensor node of claim 1, wherein data processing is controlled using at least one processing hierarchy, the at least one processing hierarchy controlling at least one event selected from a group consisting of data classifications, data transfers, data queuing ~~queing~~, data combining, processing locations, communications among the plurality of network elements.

Claim 28. (Original) The sensor node of claim 1, wherein data is transferred using message packets, wherein the message packets are aggregated into compact forms in the plurality of network elements using message aggregation protocols, wherein the message aggregation protocols are adaptive to data type, node density, message priority, and available energy.

Claim 29. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the functions of the at least one node include data acquisition, data processing, communication, data routing, data security, programming, and node operation.

Claim 30. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the at least one node includes at least one processor coupled to a plurality of application programming interfaces (APIs), wherein the plurality of APIs are coupled to control the sensor node and at least one device selected from a group consisting of sensors, actuators, communications devices, signal processors, information storage devices, node controllers, and power supply devices, wherein the plurality of APIs support remote reprogramming and control of the at least one device, wherein the plurality of APIs are layered.

Claim 31. (Original) The sensor node of claim 30, wherein the plurality of APIs enable distributed resource management by providing network resource information and message priority information to the plurality of network elements, wherein information transfer among the plurality of network elements is controlled using a synchronism hierarchy established in response to the resource information and message priority information.

Claim 32. (Currently Amended) The sensor node of claim 1 +5, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the at

least one node controls data processing and data transmission in response to a probability of a detected event.

Claim 33. (Currently Amended) The sensor node of claim 1-15, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the plurality of network elements are self-assembling, wherein search and acquisition modes of the at least one node search for participating ones of the plurality of network elements, wherein a determination is made whether each of the participating ones of the plurality of network elements are permitted to join the sensor network using a message hierarchy, wherein the sensor network is surveyed at random intervals for new nodes and missing nodes.

Claim 34. (Currently Amended) The sensor node of claim 1-15, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein the plurality of network elements further include at least one database, wherein the at least one database includes at least one storage device selected from a group consisting of storage devices coupled to at least one of the plurality of network elements and storage devices of the at least one node, wherein the at least one database comprises data-driven alerting methods that recognize conditions on user-defined data relationships including coincidence in signal arrival, node power status, and network communication status.

Claim 35. (Currently Amended) The sensor node of claim 1-15, wherein the plurality of network elements comprise a sensor network including at least one node, and wherein data is collected from the sensor node by the at least one node, wherein at least one operation is performed on the data in response to parameters established by a user, the at least one operation selected from a group consisting of energy detection, routing, processing, storing, and fusing, wherein the routing, processing, storing, and fusing are performed in response to at least one result of the energy detection.

Claim 36. (Original) The sensor node of claim 34, wherein the routing comprises selecting at least one data type for routing, selecting at least one of the plurality of network elements to which to route the selected data, selecting at least one route to the selected at least one of the plurality of network elements, and routing the selected at least one data type to the selected at least one of the plurality of network elements.

Claim 37. (Original) The sensor node of claim 34, wherein the processing comprises selecting at least one data type for processing, selecting at least one processing type, selecting at least one of the plurality of network elements to perform the selected at least one processing type, and transferring the selected at least one data type to the selected at least one of the plurality of network elements using at least one route through the sensor network, wherein the selection of at least one processing type comprises determining at least one probability associated with a detected event and selecting at least one processing type in response to the at least one probability.

Claim 38. (Original) The sensor node of claim 34, wherein the storing comprises selecting at least one data type for storage, selecting at least one storage type, selecting at least one of the plurality of network elements to perform the selected at least one storage type, and transferring the selected at least one data type to the selected at least one of the plurality of network elements using at least one route through the sensor network.

Claim 39. (Canceled)

Claim 40. (Original) The sensor node of claim 1, wherein at least one of the plurality of network elements determines a position of the sensor node.

Claim 41. (Original) The sensor node of claim 1, wherein the sensor node determines at least one position using location information received from at least one of the plurality of network elements.

Claim 42. (Canceled)

Claim 43. (Original) The sensor node of claim 1, wherein the at least one substrate comprises a thin film tape, wherein the thin film tape includes an adhesive.

Claim 44. (Canceled)

Claim 45. (New) The sensor node of claim 1, wherein the at least one substrate operates as an acoustic sensor and source.

Claim 46. (New) The sensor node of claim 1, wherein the at least one substrate comprises a material suitable for unrolling as a sensor tape to different lengths.

Claim 47. (New) The sensor node of claim 1, wherein the at least one energy source is a photovoltaic device incorporated in or mounted on the at least one substrate.

Claim 48. (New) The sensor node of claim 1, wherein the at least one substrate operates as a vibration and acoustic sensor.

Claim 49. (New) The sensor node of claim 1, wherein:
the at least one substrate operates as an accelerometer; and
the at least one energy source comprises one or more battery cells operable to serve as proof masses for the accelerometer.

Claim 50. (New) A sensor node comprising:

a flexible substrate;

a processor incorporated in or mounted on the substrate, wherein the processor is configured to automatically join another node to form a network; and

an antenna incorporated in or carried on the substrate and electrically coupled to the processor for wireless communication with the another node.

Claim 51. (New) The sensor node of claim 50 wherein the flexible substrate is configured to operate as a sensor in an accelerometer.

Claim 52. (New) The sensor node of claim 50 further comprising a photovoltaic device incorporated in or mounted on the substrate, wherein the photovoltaic device is electrically coupled to provide an energy source for operation of the processor.

Claim 53. (New) The sensor node of claim 50 wherein the flexible substrate has an aerodynamic shape suitable for deployment by air.

Claim 54. (New) A sensor node comprising:

an annular ring antenna comprising at least one ring positioned on a dielectric substrate above a ground plane;

a processor configured for wireless communication to automatically assemble into a network with other nodes using the antenna;

at least one sensor coupled to provide data to the processor;

a battery to provide power for operation of the processor; and

wherein the processor, the at least one sensor, and the battery are enclosed in the interior region of the antenna.

Claim 55. (New) The sensor node of claim 54 wherein the processor, the at least one sensor, and the battery are enclosed in the interior region of the antenna so as to provide a resonant antenna structure.